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Barriers to the Use of CHP
M.I.T. PERSPECTIVES

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All thoughts and comments contained in this presentation are those of the speaker, Mr. Connors, and do not necessarily reflect the views and opinions of M.I.T., the M.I.T. Department of Facilities, or other related entities. Any factual errors in the motivations, timing and magnitude of activities are solely those of the author.

WHY DID M.I.T. DECIDE TO COGENERATE?

- Price volatility in the broad energy sector.
- Problematic power quality and reliability.
- Existence of sizable electric and thermal loads.
- Antiquated steam plants.

WHAT DID M.I.T DECIDE TO DO?

- Replace (some) existing gas and residual oil fired boilers with a topping combustion turbine.
- Negotiate with Commonwealth Energy subsidiaries COM/Electric and COM/Gas for long-term natural gas and standby and supplementary power contracts.

Being in the Right Place, at the Wrong Time.

SOME SPECIFICS…

- System designed to supply 94% of M.I.T.'s electricity, heating and cooling needs, and 20 MW of M.I.T.'s average 23 MW load.
- 20 MW ASEA BROWN BOVERI GT10A Combustion Turbine with Dry, Low NO_x Combustors and CO Catalysts
- Replace two of five existing boilers (1950s vintage) effecting a 45% reduction in annual NO_x, CO and VOCs.
- Consolidate campus electrical system from three to one utility interconnections, and create the ability to isolate internal faults.
- In 1994, estimated utility savings were 15% over twenty years, with a payback time of seven years.

Sounds pretty straight forward, doesn't it?

M.I.T. – A BIG FISH IN A SMALL POND…
or "WHAT'S TECHNOLOGY GOT TO DO WITH IT?"

Year	† *Relevant "World" Events* • *MIT Construction Activities*	• *Contractual/Regulatory/Legal Activities*
1978	† *PURPA*	
1984	• MIT Begins Detailed Evaluation of Cogen	• Begin Stand-By & Supplementary Rate Negotiations
1990	† *Reauthorization of the Clean Air Act*	
1992	† *Rio Treaty* † *Energy Policy Act of 1992* • Full Approval Given by MIT	• Provisional Air Plan Approval (4/92) • Begin Natural Gas Contract Negotiations
1993	• Mass DEP Regs. Modified • Construction Begins/Consolidation of Distribution Systems	• Natural Gas Contract Signed (1/93)
1994	• Primary Facilities Construction	• MIT Receives QF Permit (2/94)
1995	• CT Delivered (5/95) • Cogen Unit Operational (11/95)	• MIT Files w/ DPU for Just & Reasonable Standby Power Rates (2/95) • COM/Electric request CTC (4/95) • DPU Grants ≈75% of CTC request (9/95) • MIT Files w/ Mass. SJC (10/95)
1996	† *FERC Order 888 (4/96)*	• MIT Requests FERC Ruling (1/96) • Appeal FERC Ruling in US District Court (2/96) • Testimony at Mass. SJC (10/96)
1997	† *Mass. Elec. Restrucuting Law passed (11/98)*	• Mass. SJC Overturned DPU 75% CTC ruling (9/97)
1998	† *Restructuring Ballot Challenge fails (11/98)*	• MIT and Cambridge Electric agree to arbitration of CTC (11/98)

ELEMENTS OF THE SEPTEMBER 18th, 1997 SJC RULING

THE EX-POSTE "CUSTOMER TRANSITION CHARGE" (CTC)

- Mass. DPU in Sept'95 grants COM/Electric 75% of their requested transition charge. $1.3 Million for four years, thereby increasing M.I.T.'s cost of generation by ≈1¢/kWh.

THE SJC RULING...

- Strict Standard of Prudently Incurred Costs
  (M.I.T. shared data with Cambridge Electric as early as 1985.)
- Aggressive Mitigation Efforts Required
  (Were steps to reduce standard costs taken, in conjunction with M.I.T.?)
- Calculation of Standard Costs
  (Was the methodology employed by Cambridge Electric fair?)
- Fairness of the Charge
  (Which "policy environment" should the decision be made in?)

REGULATORY DEAL-BREAKERS: THE REGULATIONS THEMSELVES, OR THE REGULATORY UNCERTAINTY?

Recall, M.I.T.'s goal was cost stabilization...

- Earlier, modifications to State NO_X Emissions regulations were required allowing the use of dry low NO_X combusters in place of SCRs. (Water injection was deemed insufficient.)
- Current – Sizable transition charge on long-lead time cogeneration facility. Legal challenge also expensive.
- Will all this be moot when restructuring dockets implemented?

What might have M.I.T. done differently?

- Leave nothing to chance in the regulatory arena.
- Have COM/Energy build and operate M.I.T. Cogen Facility.

BROADER LESSONS: THE NEED FOR A "PLUG & PLAY" ENVIRONMENT FOR DISTRIBUTED GENERATION

- **Technological Plug & Play...**
  including power/distribution system impacts & benefits, etc.
- **Regulatory Plug & Play...**
  rate provisions and performance standards, etc.
  (M.I.T currently pays the CTC, a standby power (demand) charge, a supplemental power charge and a maintenance rate for its electrical service.)
- **A Stable Decision-Making Environment**
  Are We There Yet?

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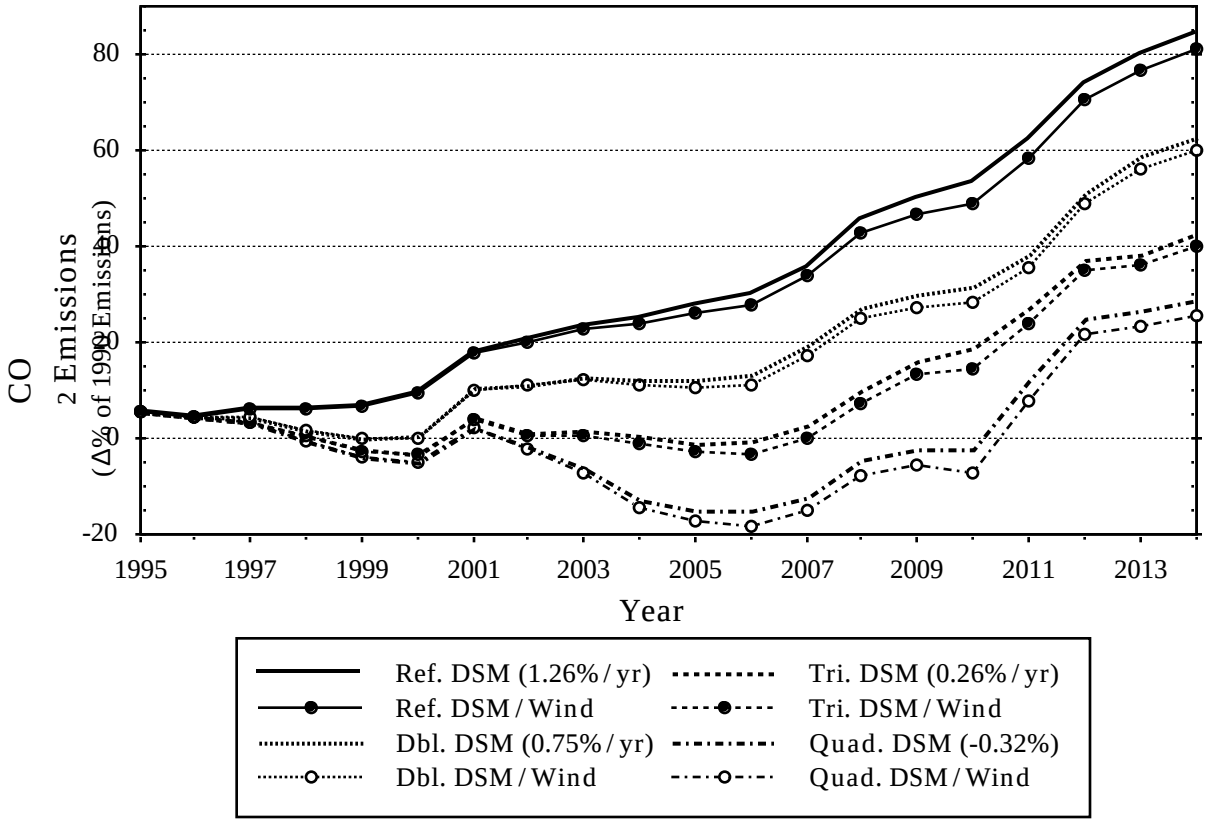
Mr. John DeTore, Rubin and Rudman, Counsellors at Law, 50 Rowes Wharf, Boston MA 0211-3319

THE KYOTO TARGET. AN EASY FIX?
NEW ENGLAND – "You Can't Get There From Here"

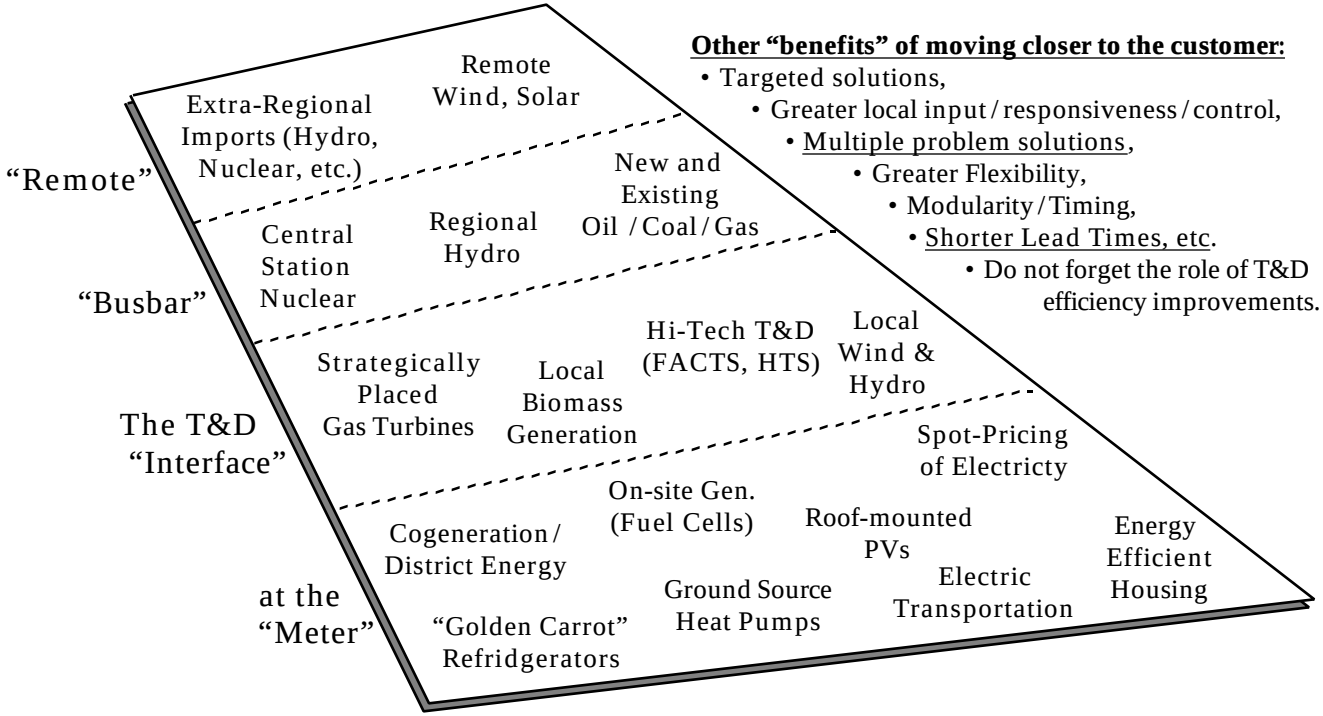


SUBSTANTIAL & SUSTAINED REDUCTIONS OF GHG GASES WILL BE DIFFICULT TO ACHIEVE.

- **COORDINATED INFRASTRUCTURE TURNOVER IS KEY.**
  - Supply-Side (old & new), Demand-Side (old & new)
  - Ability to coordinate Supply & Demand-Side infrastructure improvements getting difficult.
- **NATURAL GAS IS ONLY A QUICK FIX .** (If even that.)
  - Only reduces GHG when displacing old worse fossil.
  - No good with "new load" or lost non-CO_2 generation.
- **SUFFICIENT "COST-EFFECTIVE" NON-CARBON TECHNOLOGIES DON'T EXIST.**

  ...not for the level of penetration required.
- **CAN ELECTRIC/ENERGY INDUSTRY RESTRUCTURING HELP/HURT?**

WHERE DO TECHNOLOGY SOLUTIONS LIE?
– *THE "DISTRIBUTED UTILITY"* –



Other "benefits" of moving closer to the customer:
- Targeted solutions,
- Greater local input / responsiveness / control,
- Multiple problem solutions,
- Greater Flexibility,
- Modularity / Timing,
- Shorter Lead Times, etc.
- Do not forget the role of T&D efficiency improvements.

- A commodity market for electrical energy is **bad**.
- Finding efficiency improvements in Space & Time.
- Developing a vibrant retail market is essential.
- Energy efficiency & operational efficiency.
- "Moving towards the customer."
- Every market's a niche market.

FACILITATING NICHE MARKETS…
ENABLING BUYERS AND SELLERS

WHAT GETS MEASURED, GETS MANAGED.

JOHN BROWNE, CEO BRITISH PETROLEUM.
19 MAY 1997, STANFORD BUSINESS SCHOOL

- **FUELS** – Promoting Energy and Operational Efficiencies
- **GENERATION** – Promoting Supply-Chain Solutions
- **TRANSMISSION**
- **DISTRIBUTION**
- **METERING AND BILLING**
- **ENERGY SERVICES** (Combined Heat & Power, Smart Loads)
- **CONSUMPTION** (CHP *encore*, End-Use Efficiency)
- **ENERGY-RELATED SERVICES** (HVAC, Comfort, IAQ)

THERE ARE SIGNIFICANT (AND SEVERE) BIASES IN THE ENERGY DEBATE

- **SUPPLY-SIDE BIASES**.....(Not Enough Focus on End-Uses / Delivery)
- **ELECTRICITY BIAS** ..... (Not Enough Focus on Fuels / Transportation)
- **AIR EMISSIONS BIASES**..... (Multiple Emissions–Soil / Water)
- **COMPONENT BIASES**.....(Long-Term Infrastructure Management)

INTEGRATION, INTEGRATION, INTEGRATION

PARTING SHOTS – THINGS TO REMEMBER

From the Market Side...

- **EVERY MARKET'S A NICHE MARKET.**.....(Fair & Uniform Rules)
- **LOOK BEFORE YOU LEAP.**.....(Ensure Customer Choice)
- **WHAT GETS MEASURED, GETS MANAGED.**(Get what you Pay For)
- **COMMODITY ELECTRICITY IS BAD.**.....(Generation's only part)

From the Environmental Side...

- **CAN'T GET THERE FROM HERE.**.....(Emissions & Technology)
- **EVERYTHING IN MODERATION.**..... (Supply-chain solutions)
- **SLOW AND STEADY WINS THE RACE.**..(Infrastructure Management)

And Finally...

- **DON'T LET THE TAIL WAG THE DOG.**..(Stranded costs / PBR of Wires)